meteorites

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SOME BASIC FACTS

A *meteor* or "falling star" as it is often called, is actually not a star at all, but a stone from space which is falling through the atmosphere of the earth. The light we see is caused by the heating effect of air rushing past the stone. The term *fireball* is often used to describe a very bright meteor.

The falling stone is usually completely destroyed before it reaches the earth, but if it is not destroyed, we may find it on the ground. It is then called a meteorite. Only the very brightest fireballs will drop meteorites. Every day thousands of faint meteors may be seen to burn up more than 50 miles above the earth.

When a meteor first meets the atmosphere, it is travelling at least 7 miles a second, and perhaps as much as 45 miles a second. The air slows it down so that if it hits the earth it will be going only a few hundred miles an hour. For the last few miles of its fall it travels too slowly to be luminous and when it strikes the ground it is seldom hot and never burning.

A meteorite often breaks up as it falls; dozens or even thousands of pieces may fall in a few square miles. Pieces may weigh a fraction of an ounce, or they may weigh tons, but the most common size found is a few pounds. They may bury themselves a few feet into the ground, or they may rest on top, depending mainly on the surface they strike.

WHY WE STUDY METEORITES

Meteorites give us information about the solar system. We know that the solar system contains more than just the sun, the earth, and the other eight planets with their moons. It contains smaller objects which also circle the sun; these are called *asteroids* and *comets.* Asteroids are just rocks in space; they are thought to be pieces of small planets which have broken up. Pieces of asteroid material become meteorites when they happen to hit the earth. Small pieces left behind by comets produce the faint meteors which never reach the ground. The faint meteors from comets occur in showers at certain times during the year, but fireballs which produce meteorites can happen at any time of the day or year.

Laboratory studies can determine the age of a meteorite (billions of years), what it is made of and what has happened to it during its existence. Scientists are actually very lucky to have these samples from space coming here to them; it would

be almost impossible to go into space to collect such pieces.

At least eight different kinds of scientists want to study meteorites.

Astronomers want to learn about the origin, age, chemical composition, and development of meteorites. This helps them understand the history of the solar system. Meteorites tell us what the solar system used to be like. Astronomers also want to learn from photographs of the falling meteor just where it came from in space.

Geologists want to study the unusual minerals in meteorites. In this way they can learn about the earth itself, because meteorites may be like the deep interior of the earth or like the earth used to be. Geologists also want the unique opportunity of studying these pieces of another planet.

Chemists want to study the chemical composition of meteorites, because meteorites were formed under conditions that cannot be duplicated in a laboratory.

Metallurgists want to study the unusual forms of the metals in meteorites. These were created under great heat and pressure during billions of years, and their structures are unlike any at the surface of the earth.

Nuclear Physicists want to study the radioactive minerals created in the meteorites by the cosmic rays of space and also the by-products of former radioactivity which may now have disappeared. (The radioactivity is too weak to be harmful.)

Aerodynamicists want to study the flight of meteorites and the effects of their supersonic flight through the atmosphere. The air, streaming over the surface of the stone, causes distinctive markings. Meteorites travel faster than any rocket which can yet be made; studying them may help the designers to improve the shape of rockets, or the material of which rockets are made.

Space Scientists want to learn about meteorites in space because they could be dangerous to space ships. These men also want to obtain information from meteorites about cosmic rays in space, because these rays are harmful to humans.

Biologists are interested in complex carbon molecules which are occasionally found in meteorites. These may be a first step in the evolution of life from simple chemicals.

Meteorites are in great demand and the supply is small. There is a particular demand for fresh meteorites which have not been on the ground for very many days. The ground and the air soon contaminate meteorites, and when a meteorite is no longer in space the special chemical elements created by the cosmic rays begin to decay. A meteorite which was actually seen to fall by enough witnesses, or which was photographed, is the most valuable of all, because its orbit in space can be calculated.

PRICE OF METEORITES

Meteorites are valuable only for scientific purposes. The federal government guarantees to buy a new Canadian meteorite for at least $100.00. The actual price depends on the type of meteorite (some are more rare), its size, its freshness and condition, and what is known about its fall.

Part of the iron meteorite found in 1916 near Annaheim, Sask. The pitted, black outer surface is typical of irons. The flat side has been cut, polished and etched to reveal the crystal pattern of the nickel-iron alloy.

There are three kinds of meteorites. They may be found in any size and weight.

1. *Iron meteorites* are easy to recognize because they are twice as heavy as any normal rock the same size. They look, feel, sound and weigh like a piece of iron, and they are magnetic. If fresh, they have a black crust all over. Their surface is usually quite irregular, with pits, valleys and depressions. People often say that the surface looks as if it had been soft and that finger and thumb marks had been pressed into it. A few iron meteorites are not like this; these are shaped like a bullet, and their surface has many fine lines where melted metal has trickled over it.

2. *Stony meteorites* are more difficult to identify. The best clue is a thin black crust all over. If this crust is chipped, the interior often looks like concrete, but may be any colour. The surface usually has some shallow pits like the ones on iron meteorites. If you suspect a meteorite, grind off a small

corner with an emery wheel (not a file). You may see silvery specks of nickel and iron. Do not be confused by other shiny specks that are found in many rocks; the nickel and iron can be identified by picking off a speck and finding if it is magnetic. Shiny magnetic specks are a good sign of a meteorite.

You may also see tiny round or oval grains in the stone, usually about a tenth of an inch or even less in size. These are called *chondrules* and are best seen with a magnifying glass. Many ordinary rocks have grains with square corners, but chondrules are different — they are always round.

3. *Stony-iron meteorites* are a mixture of stony material and iron. These meteorites have deep pits on their surface, and the usual black crust. They are quite heavy for their size and they are magnetic. If you grind off a corner, you will see either pure iron, which is easy to recognize, or the stony material described above.

THESE ARE SOME VERY GOOD CLUES THAT A ROCK IS *NOT* A METEORITE

- A meteorite is *not* light and airy.
- It does *not* contain bubble holes.
- It does *not* contain shiny crystal grains of quartz or mica.
- It does *not* contain fossils.
- It is *not* formed in layers or shells.
- It is *not* found imbedded in another rock.
- It is *not* almost perfectly round like a ball.

Two individual fragments of the shower of stony meteorites which fell near Bruderheim, Alberta, on March 4, 1960. The thin black fusion crust has been chipped on the larger piece and shows some of the grey interior of the stone.

WHERE TO LOOK FOR METEORITES

- Any rock found on ice is especially worth suspecting. A meteorite will usually not break through thick ice.
- A rock which has appeared suddenly in a field should be examined to see if it passes the tests listed here.
- A meteorite may be at the bottom of a small pit caused when the object struck the ground. This may be a few inches or a few feet deep.
- A meteorite may be near a pit or disturbance of the ground. Sometimes the falling object will bounce out of the hole it makes. A person should look for a meteorite if he finds some new disturbance of the ground.
- Many meteorites are probably lying in farmers' stone piles.
- The fall of a meteorite usually causes a rumbling sound like thunder. If a person hears such a sound but cannot see a thunder-

storm or an airplane, there may be a new meteorite nearby. He should note the time of the sound, and be watching for the meteorite on the ground.

- If you think you have found a meteorite, be sure to note carefully and remember the place where it was found.

IF YOU SUSPECT A METEORITE

Suspected meteorites will be gladly examined at the following places:

IN EASTERN CANADA

Dominion Observatory,
Ottawa, Ontario.
or
Geological Survey of Canada,
or
Meteorite Identification,
Ottawa, Ontario.

IN WESTERN CANADA

(a project of the Dominion Observatory)
Meteorite Observation and Recovery Project,
Physics Department,
University of Saskatchewan,
Saskatoon, Sask. (Telephone 652-6450).

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